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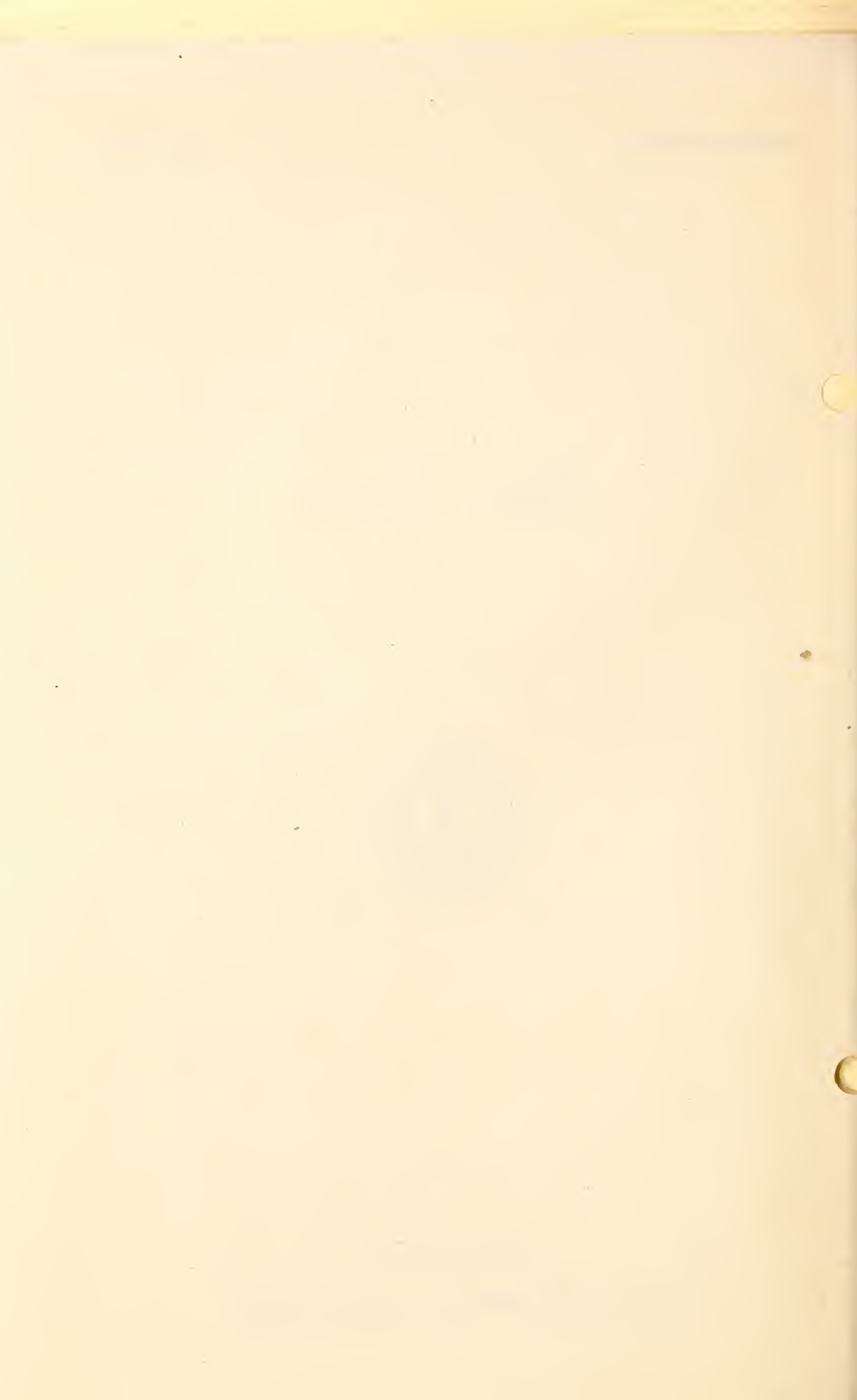


# *Sitka Spruce*



Forest Service

U. S. DEPARTMENT OF AGRICULTURE



# SITKA SPRUCE

(*Picea sitchensis*)

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Sitka spruce is a tree of large size and splendid form, growing along the northwestern coast of North America from California to Alaska. Up to the time of World War I, Sitka spruce was used largely in local consumption. During that war, however, the exceptional suitability of the wood for aircraft construction brought it into general demand both in this country and abroad. The requirements for aircraft use are so exacting that even in the case of Sitka spruce generally not more than 5 percent of the lumber in a normal stand can be utilized. World War II has again brought about a heavy demand, and all the material of aircraft grade is reserved for use in this country or shipped abroad to our allies.

The bulk of the Sitka spruce lumber produced is normally used for boxes and crates, planing-mill products, furniture, sash, doors, blinds, and general millwork. The wood has excellent pulping properties and is used in considerable quantities on the west coast for paper pulp. Trees have been recorded with heights of over 280 feet, diameters of over 10 feet, and ages ranging up to 600 years. The rapid growth of Sitka spruce in its early life and the large yield per acre, combined with the value of the wood for lumber and paper pulp, assure the species careful consideration in forest management plans for the northern Pacific coast region.

**Nomenclature.**—The generally accepted name Sitka spruce is sometimes shortened to "spruce." Other names used, especially locally, are yellow spruce, tideland spruce, western spruce, silver spruce, and west coast spruce.

**Distribution and growth.**—Sitka spruce grows in a strip along the Pacific coast from northern California to a little beyond Cook Inlet in Alaska. (Fig. 1.) It is rarely found over 40 miles from the coast and generally grows in mixture with other species but occasionally forms pure stands. In Oregon and Washington it is commonly found in mixture with Douglas-fir, grand fir, western hemlock, and western redcedar. In the coastal forests of Alaska, Sitka spruce and western hemlock make up the bulk of the stand.

Forest-grown Sitka spruce trees are tall and straight with open, conical crowns. In trees approaching maturity the long, cylindrical boles are frequently clear of branches for distances of 40 to 80 feet from the ground. Their bases are commonly heavily buttressed. The tree produces large quantities of seed with a high rate of germination and persistent vitality. The seedlings grow well on any moist soil and can endure dense shade. After the seedling stage, however, the trees must have overhead light for rapid growth. The average

diameters<sup>1</sup> and heights of comparatively young dominant stands of Sitka spruce trees in Washington and Oregon were as follows: 20 years, diameter 2 inches, height 31 feet; 40 years, diameter 9.5 inches, height 70 feet; 60 years, diameter 15.7 inches, height 104 feet; 80 years, diameter 20.5 inches, height 132 feet.

Sitka spruce is a very long-lived tree. Mature trees in Washington and Oregon commonly attain an age of 400 to 450 years and are from 4 to 6 feet in diameter and over 200 feet in height. In Alaska the average dimensions of mature trees are somewhat less.



FIGURE 1.—Range of sitka spruce (*Picea sitchensis*) in continental United States.

**Supply.**—The stand of Sitka spruce of saw-timber size was estimated in 1918 as follows:<sup>2</sup> Continental United States, 11,136,000,000 board feet; Alaska, 15,000,000,000 to 18,000,000,000 board feet; and British Columbia, 15,186,000,000 board feet. Of the amount in Continental United States 6,535,000,000 board feet was placed in Washington, 4,374,000,000 board feet in Oregon, and 187,000,000 board feet in California.

<sup>1</sup> The diameter is measured outside of the bark at 15 feet above ground in order to avoid the swell at the butt.

<sup>2</sup> CAREY, N. LEROY. SITKA SPRUCE—ITS USES, GROWTH, AND MANAGEMENT. U. S. Dept. Agr. Bul. 1060, 38 pp., illus. 1922.



A later estimate based on a forest survey of western Washington and western Oregon<sup>3</sup> gave the stand of Sitka spruce of saw-timber size<sup>4</sup> in the western parts of these two States as 13,438,400,000 board feet.<sup>5</sup> It was made up of 7,738,100,000 board feet in western Washington and 5,700,300,000 board feet in western Oregon. The total stand of Sitka spruce saw timber in the United States at the time the survey was made, including a small allowance for California, was close to 13,500,000,000 board feet. Since that time heavy cutting, principally for aircraft stock, has undoubtedly reduced this stand. In 1942 it was estimated not to exceed 10,000,000,000 board feet.

**Production of Lumber.**—The production of Sitka spruce lumber in 1869 amounted to about 17,000,000 board feet.<sup>6</sup> (See fig. 2.) Production increased rather steadily for the next 30 years and in 1899 reached 165,000,000 board feet. After 1899 production was more irregular but it continued to increase. In 1918, because of the demand for the construction of airplanes, it reached a maximum of 508,000,000 board feet. Production decreased after the war and in 1932 fell to 80,000,000 board feet. By 1940 it had recovered to 240,000,000 board feet, the largest cut since 1929 and the beginning of the demand due to World War II. The cut in 1942 was 406,000,000 and in 1943, 370,630,000 board feet.

The average annual production of Sitka spruce lumber for the 10-year period 1934-43 was approximately 226,000,000 board feet. California led in production in 1869 and 1879. Since then, however, it has produced only a very small proportion of the total amount. Washington has been first in production since 1879, except for a few years when it was displaced by Oregon. The production of Sitka spruce lumber in Alaska in 1940 amounted to about 22,000,000 board feet, in 1942 about 35,000,000, and in 1943 about 49,000,000.

**Pulpwood.**—The consumption of Sitka spruce pulpwood in 1910 was roughly 40,000 cords. This includes 33,054 cords used in Oregon and California and a small but unknown amount used in Washington.<sup>7</sup> Since then consumption has increased irregularly and in 1939<sup>8</sup> reached 120,182 cords. Of this amount, Oregon furnished 77,374 cords and Washington 42,808 cords.<sup>9</sup> The average annual consumption of Sitka spruce pulpwood in the United States in recent years is estimated roughly at 110,000 cords, equivalent to approximately 55,000,000 board feet.<sup>10</sup>

**Cooperage.**—Statistics on spruce cooperage production (slack staves and slack heading, and tight staves and tight heading) for Sitka spruce and eastern spruce are combined except for a few years. The infor-

<sup>3</sup> Survey conducted by the Pacific Northwest Forest and Range Experiment Station during the period 1930-35 as part of a Forest Survey of the United States.

<sup>4</sup> Includes trees with a diameter of 16 inches and over breast height.

<sup>5</sup> ANDREWS, H. V., and COWLIN, R. W. FOREST RESOURCES OF THE DOUGLAS-FIR REGION. U. S. Dept. Agr. Misc. Pub. 389, 169 pp., illus. 1940.

<sup>6</sup> In the annual lumber production reports of the Bureau of the Census up to the year 1940 the reported lumber cut of all the spruces is combined and designated as "spruce." In presenting figures on the production of Sitka spruce lumber, all spruce cut in Washington, Oregon, and California has been classed as Sitka spruce. Lumber production figures for Washington, however, undoubtedly include a small proportion of Englemann spruce from the northeastern part of the State.

<sup>7</sup> The figures given for the consumption of Sitka spruce pulpwood are based on the assumption that all the spruce pulpwood used in Washington, Oregon, and California was Sitka spruce. A small proportion (less than 5 percent) of the spruce pulpwood cut in these States was probably Englemann spruce.

<sup>8</sup> The last year for which pulpwood consumption, by States and species is available.

<sup>9</sup> No mention of California has been made in recent years in the statistics of pulpwood consumption issued by the Bureau of the Census.

<sup>10</sup> A cord of Sitka spruce pulpwood contains 500 board feet.

mation available indicates that Sitka spruce furnishes nearly all the spruce cooperage. In 1929 approximately 51,300,000 Sitka spruce slack staves were produced and 5,500,000 sets of slack heading<sup>11</sup> and in 1939 approximately 37,400,000 staves and 5,300,000 sets of heading.<sup>12</sup> The production of tight staves and heading from spruce has decreased markedly in recent years, and in 1939 was only about 3,000,000 tight staves and 1,200,000 sets of tight heading.<sup>13</sup> Sitka spruce was not separated from eastern spruce. The average annual consumption of Sitka spruce for both slack and tight cooperage in recent years is estimated as equivalent to 30,000,000 board feet.

The average annual cut of Sitka spruce for all purposes in recent years in the United States (including Alaska) is estimated at 300,000,000 board feet.

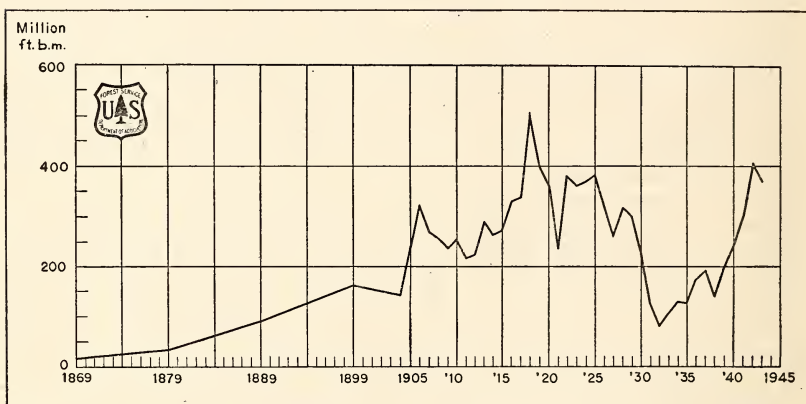


FIGURE 2.—Lumber production of Sitka spruce, 1869-1943.

**Properties.**—The heartwood of Sitka spruce is a light pinkish brown which darkens on exposure. The sapwood is creamy white and shades gradually into the heartwood. In forest-grown trees 200 years old and approximately 4 feet in diameter the sapwood is generally from 3 to 6 inches wide. In younger smaller trees, which are growing more rapidly, the sapwood may be thicker and the proportion of the cross section of a log made up of sapwood is much greater than in the more mature trees. The wood of Sitka spruce generally has a comparatively close and uniform texture. The annual rings are distinct with a band of lighter colored springwood shading gradually into a narrower band of darker summerwood. The grain is generally straight. Planed surfaces may show a silky sheen, but there is a tendency to fuzzy or wooly grain under the action of the planer knives.

The wood has no distinct taste or odor and contains very few resin ducts. It is moderately light in weight,<sup>14</sup> moderately weak in bending and compressive strength, moderately stiff, moderately soft, moder-

<sup>11</sup> During the same year (1929) eastern spruce furnished 3,055,000 slack staves and 125,000 sets of slack heading.

<sup>12</sup> During the same year (1939) eastern spruce furnished 705,000 slack staves and 22,000 sets of heading.

<sup>13</sup> In 1927 about 82,000,000 tight spruce staves and about 7,000,000 sets of tight heading were produced.

<sup>14</sup> The average weight of Sitka spruce in an air-dry condition (12 percent moisture) is 28 pounds per cubic foot.



ately low in resistance to shock and has a moderately large shrinkage. On a basis of weight, however, it ranks high in strength properties. It can be obtained in clear, straight-grained pieces of large size and uniform texture, and hidden defects are very uncommon. These factors make Sitka spruce by far the most important wood for aircraft construction. The wood works easily and is not difficult to kiln dry. In resistance to decay, Sitka spruce ranks with the hemlocks, birch, beech, and maple—above the woods of low durability but below those of intermediate durability. Thin panels of slow-growth Sitka spruce are highly resonant.

As a pulpwood Sitka spruce takes high rank on account of its long, strong fibers and the ease with which it can be pulped. It reduces readily by the sulfite process to yield a strong pulp, not quite so fine in texture as that from white spruce but one which bleaches easily to an excellent white and is suitable for the manufacture of newspaper, wrapping, book, high-grade printing and bond papers. It also reduces readily by the sulfate process to yield a strong pulp suitable for high-grade kraft wrapping papers and fiberboard. When made into pulp by the mechanical (ground wood) process, it yields a product of standard strength with a slightly gray color suitable for practically all the uses to which ground-wood is put. The power required for grinding is about the same as for white spruce, a standard wood for pulping purposes.

**Principal uses.**—Sitka spruce is used principally for lumber, paper pulp, and cooperage. Of the material sawed into lumber, some is used for construction purposes as it comes from the sawmill, but the greater part is further manufactured into various products.

Boxes and crates probably consume at least 50 percent of the remanufactured lumber. Furniture, planing-mill products (flooring, siding, ceiling, etc.), and sash, doors, blinds, and general millwork are other major uses. The speciality uses, such as aircraft construction, ladder rails, and piano sounding boards, consume only a small proportion of the remanufactured lumber—probably not more than 3 percent each. Other uses include dairy, poultry, and apiary supplies; patterns and flasks; refrigerators; and boat construction. Cooperage stock made from Sitka spruce consists largely of staves and heading for slack barrels used for shipping a wide range of products and materials. The comparatively small amount of tight cooperage stock made from Sitka spruce goes largely into butter tubs.

## REFERENCES

- CANADIAN SITKA SPRUCE. L. L. BROWN. Canada Dept. Int., Forestry Branch Bul. 71, 39 pp., illus. 1921.
- FOREST TREES OF THE PACIFIC SLOPE. G. B. SUDWORTH. U. S. Dept. Agr. Un-numbered Pub., 441 pp., illus. 1908.
- SITKA SPRUCE. E. H. FINLAYSON. Canada Dept. Int., Forest Serv. Tree Pam. 12, 6 pp., illus. 1926.
- SITKA SPRUCE: ITS USES, GROWTH AND MANAGEMENT. N. L. CARY. U. S. Dept. Agr. Bul. 1060, 38 pp., illus. 1922.
- YIELD OF EVEN-AGED STANDS OF SITKA SPRUCE AND WESTERN HEMLOCK. W. H. MEYER. U. S. Dept. Agr. Tech. Bul. 544, 86 pp., illus. 1937.

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